Successful Safety Strategies at Signalized Intersections In Holland and Port Huron

Michigan Traffic Safety Summit

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Highlighted Projects

- City of Holland; reconstruction of River and Michigan Avenues
- City of Port Huron; traffic signal system and modernization
- FHWA; Driver Behavior Study, Wyoming
- Theme: urban areas that could benefit from improved traffic operations and safety

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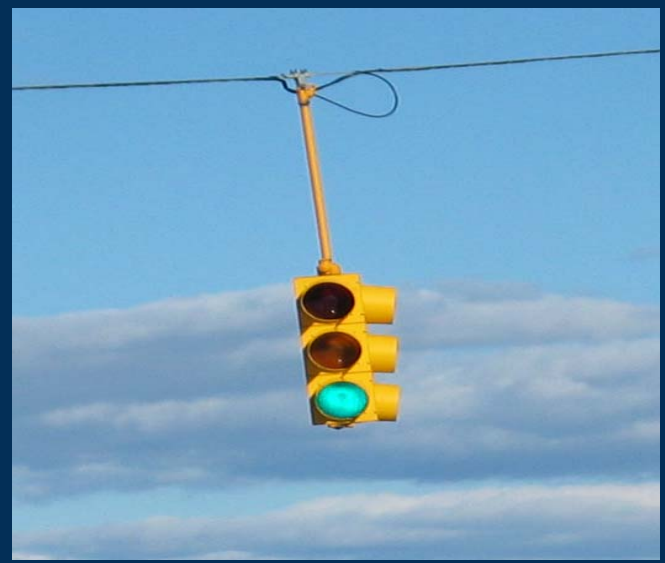
Safety Strategies at Signalized Intersections

- Require no additional pavement or right-of-way
- Have generally neutral or positive effect on efficiency
- Small incremental cost
- Maintenance impact neutral or positive



This is “low hanging fruit”!

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River and Michigan Corridor; Holland

- Typical urban 4-lane corridor
- Feeds Downtown Holland and crosses Black River
- Narrow (10') lanes, ROW constrained
- Significant turning traffic, no exclusive left-turn lane

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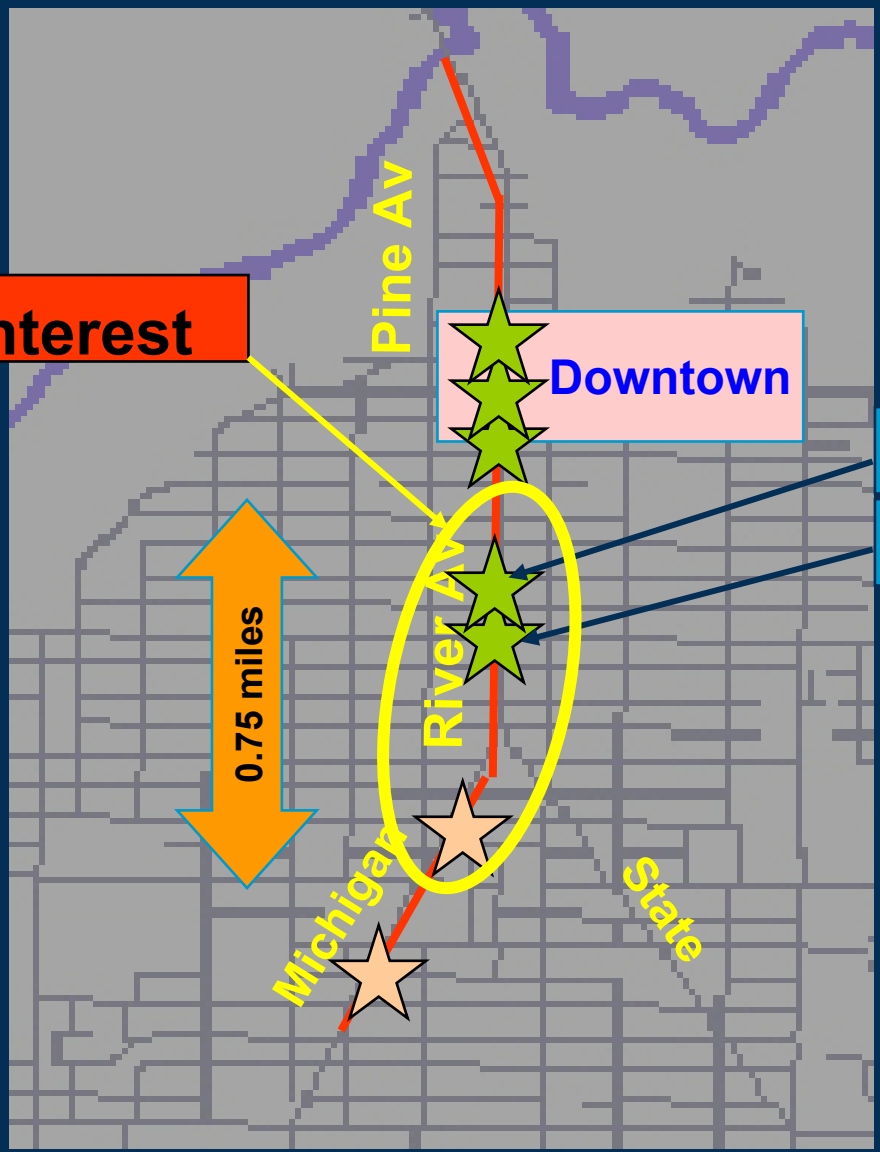
River and Michigan Reconstruction



North

Area of Interest

8th St

16th Street

17th Street

16th St

24th St

Existing signal

Proposed signal

32nd St

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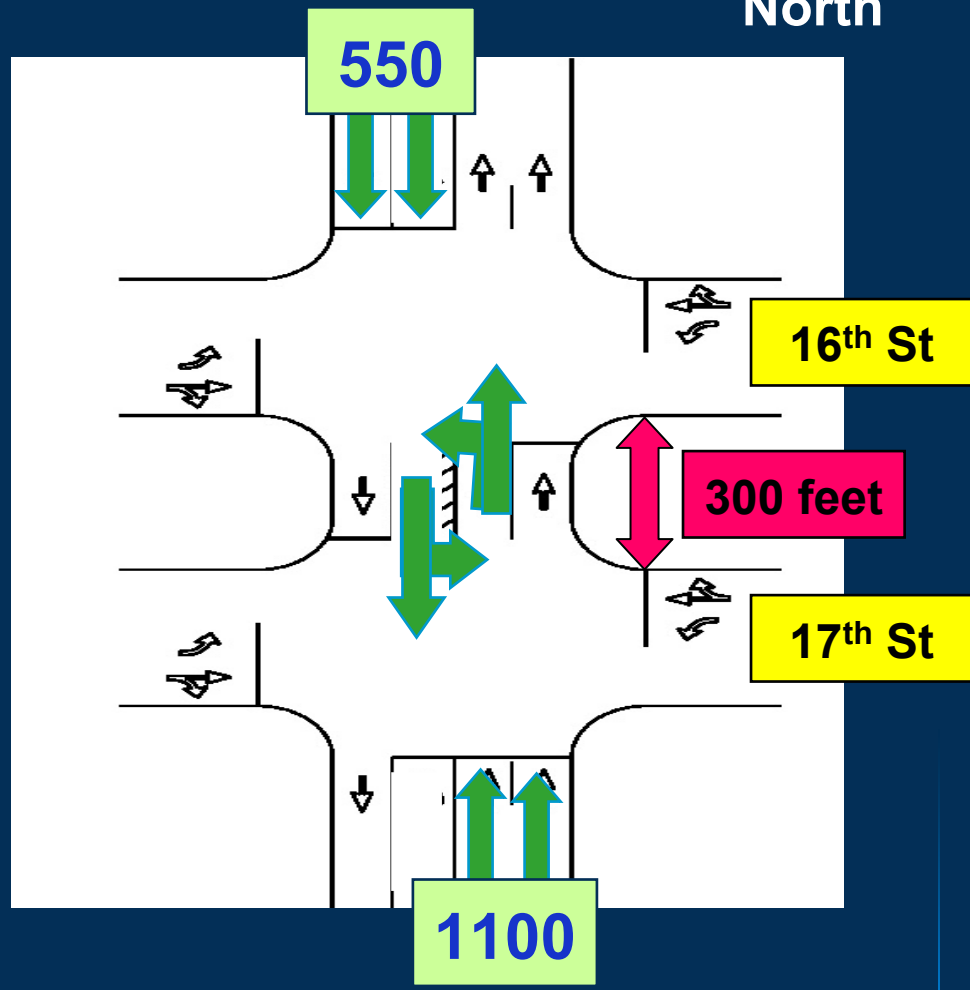
16th & 17th Streets – Previous Configuration

- The "pressure point" for the corridor
- Left-turn movement and phases "in middle"
- Imbalanced traffic volumes
- Significant crash history



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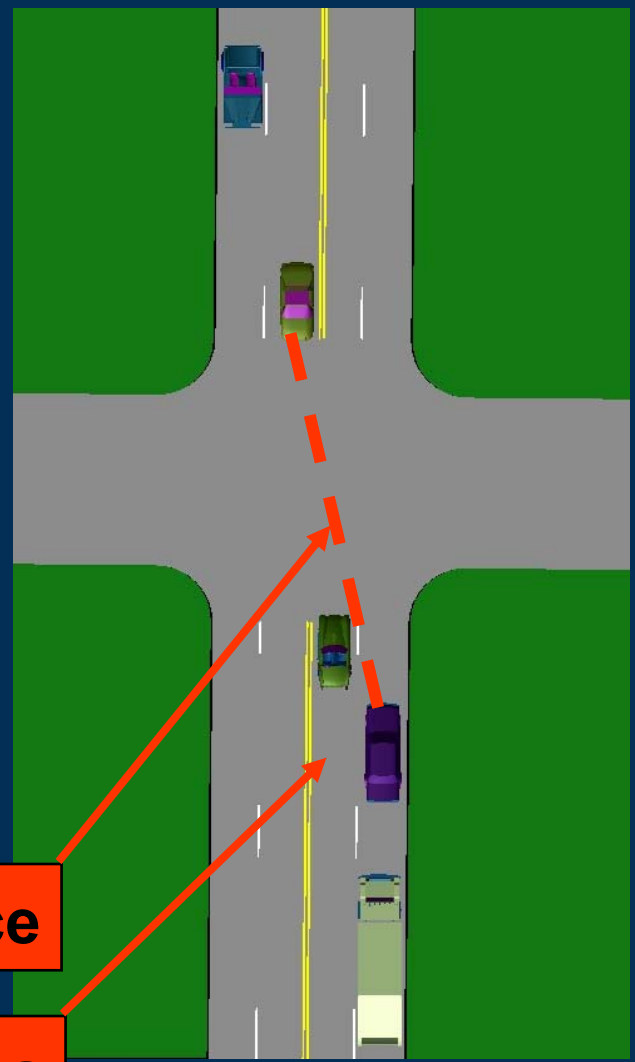
Left-turn Movement Visibility

- **Off-set left-turn compromises left-turn movement visibility**
- **High number of right-angle crashes**
- **Through traffic weaves around left-turning traffic**
- **High number of rear-end crashes**



Highest Crash Locations

Average annual crashes (1999-2004)

Intersection	Head-On	Right Angle	Rear-End	Side-swipe
16th/River –signalized	0.9	6.5	8.2	1.8
17th/River –signalized	0.9	6.2	5.8	1.1
18th/River -unsignalized	0.4	5.3	1.8	0.4

Combined, 46 annual crashes

- **18 right-angle crashes (40%)**
- **16 rear-end crashes (35%)**

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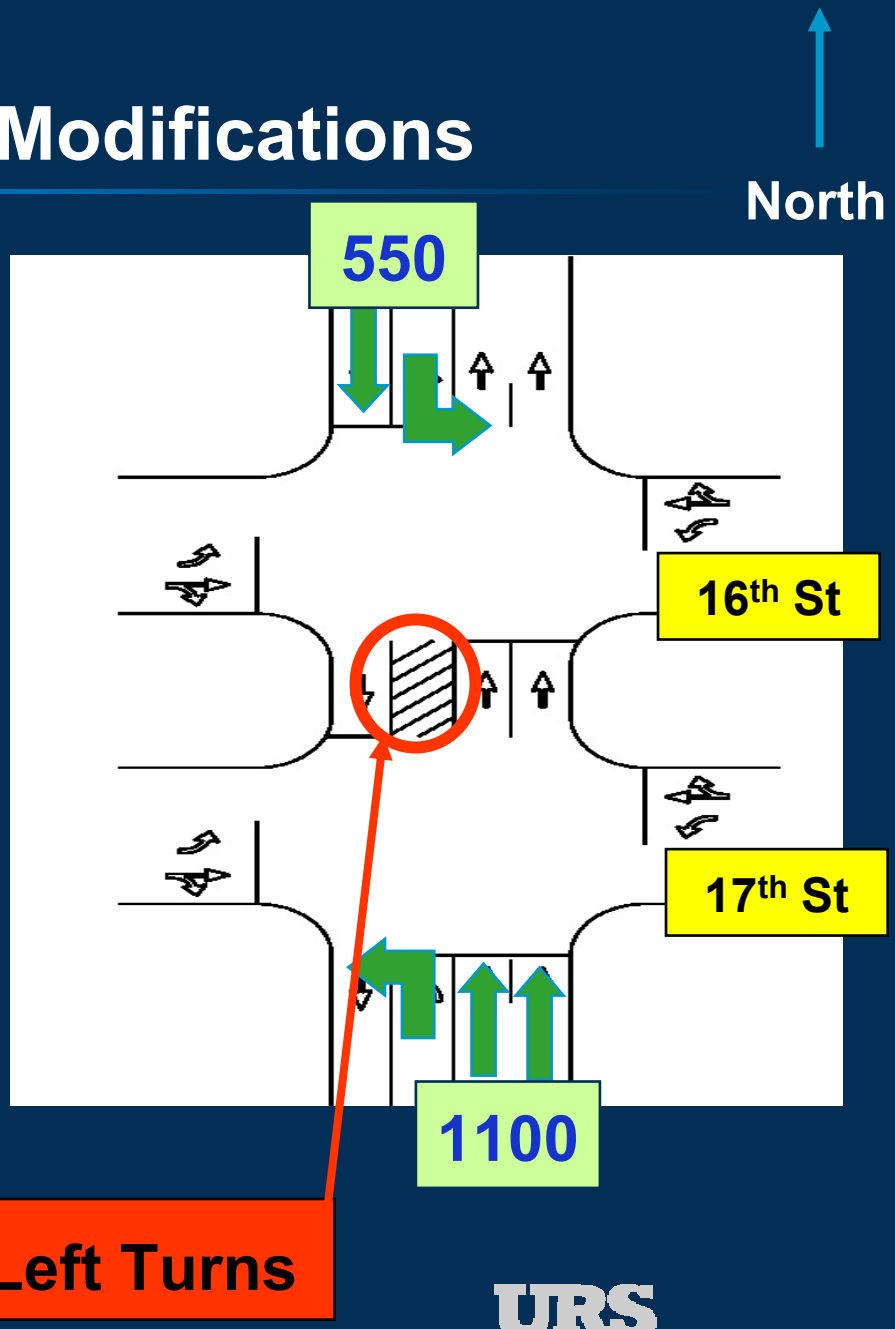
Safety Strategy – Lane Modifications

- **Modify through lanes, include exclusive left-turn lane (3/4 mile)**
- **Place left-turn movements and phases on "outside"**
- **Prohibit left-turns between intersections**



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Safety Strategy – Traffic Signal Enhancements

- **Box span traffic signal configuration**
- LED signal lamps, traffic signal backplates (tethered)
- Updated clearance intervals
- Optimized traffic signal timings

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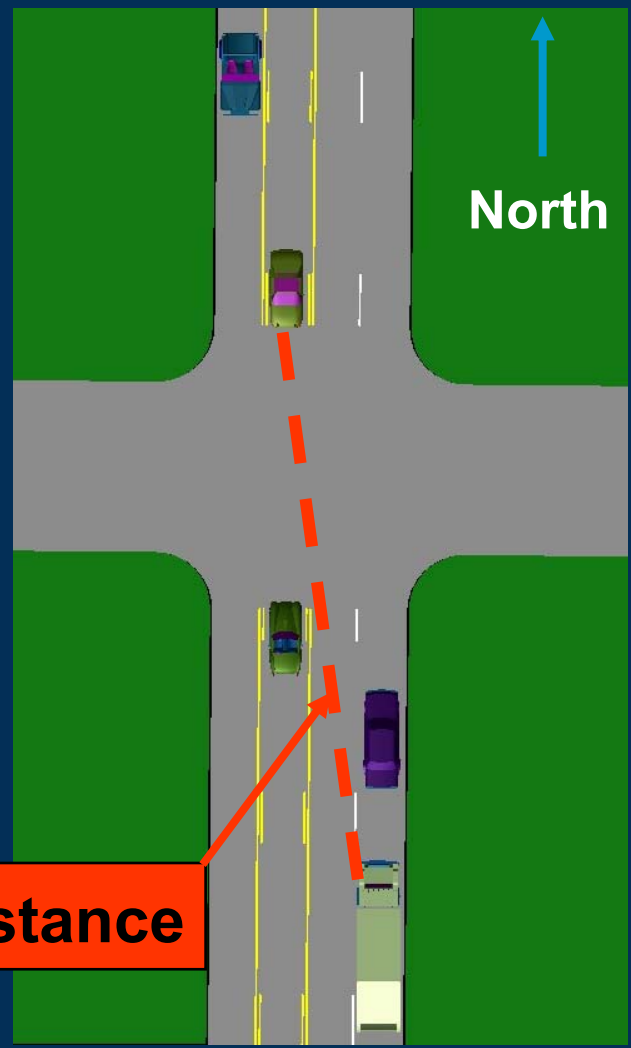
Holland Safety Results – Preliminary

Based on 3 months of "after" data (11/23/2005 – 2/23/2006):

- 16th – 18th Streets: 74% reduction (3 crashes so far)
- Corridor crash reduction for ¾ mile section: ~ 50%



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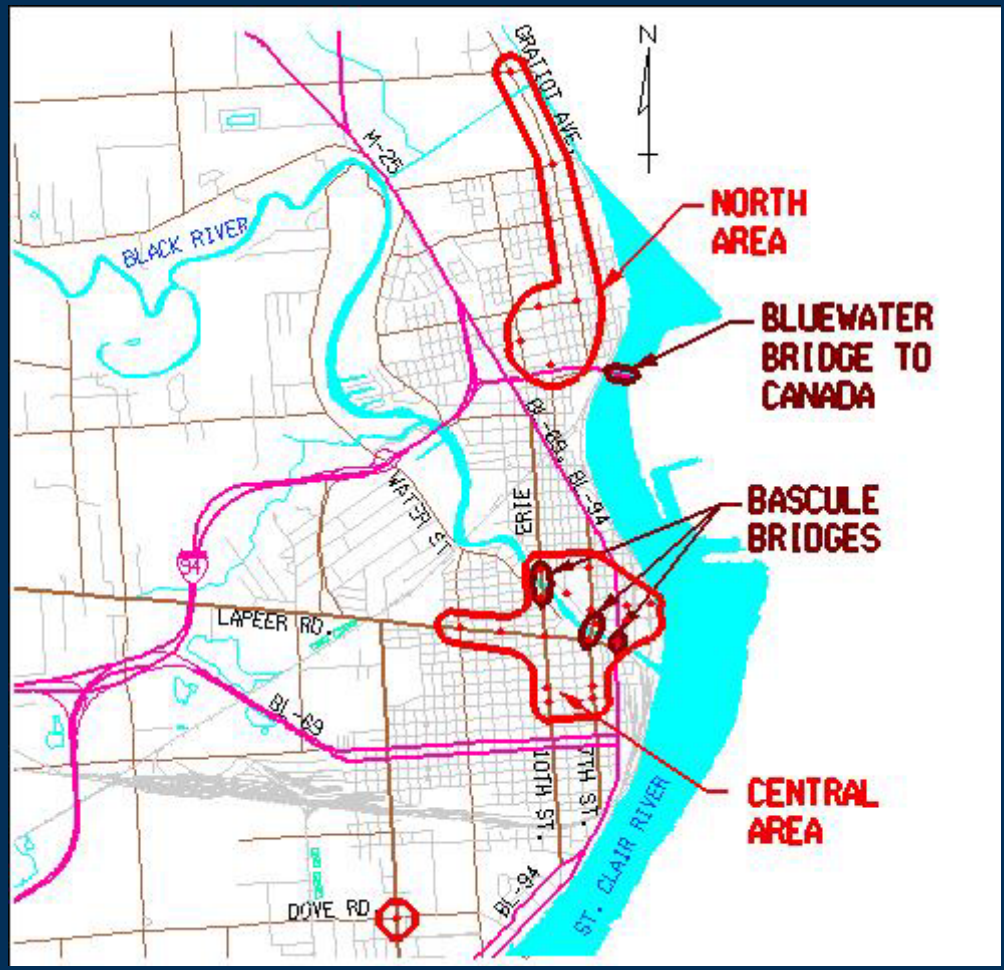
City of Port Huron Traffic Signal System

- Communications
  - 22 traffic signals
  - 3 bridge houses
  - Fire station
  - Police station
  - Engineering
- 25 bascule bridge events per day in summer



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Safety Strategy – Traffic Signal System

- Optimized traffic signal timings
- Signal timing adjustments during bridge events
- Bridge status indicator lights at fire and police stations
- Fire station indicator lights in bridge houses

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Safety Strategy – Traffic Signal Enhancements

- **Installation of box span signal configuration at 15 locations**
- Replacement of 8” signal lenses with 12” lenses at 10 locations
- Updated yellow and all-red clearance intervals
- Conversion from 4 lanes to 3 lanes at 4 intersections

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Safety Results

- Based on 2+ years of “after” crash data (fall 2003 – 12/2005):
- Overall, 47% crash reduction at 22 intersections
  - 41% right-angle crash reduction
  - 33% rear-end crash reduction
- 55% crash reduction at 15 intersections with “box span” improvement (among other improvements)

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Driver Behavior Study; Wyoming

- **Evaluate impact to driver of distance to signal face**
- Red light violation rate
- Late yellow entry (last second of yellow) rate
- Before & after study

44th Street at Clyde Park

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Traffic Signal Face Location Comparison

Before – Diagonal Span

After – Box Span

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Project Parameters

- 1 approach; 3 weeks of before and after data
- Measure “depth of yellow”, “depth of red”, and vehicle speed
- Count through vehicles (approx. 4400 per day)
- Vehicles traveling less than 15 mph are assumed to be right-turn-on-red

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Study Results

Measure	Before	After
Red Light Violation Frequency (per day)	5.5	0.9
Red Light Violation Rate (entering through vehicles)	1 per 900	1 per 4700
Late Yellow Entry Frequency (per day)	20	2.5
Late Yellow Entry Rate (entering through vehicles)	1 per 250	1 per 1600

When adjusted for traffic volume differences,

- 81% reduction in red light violations
- 84% reduction in late yellow entry

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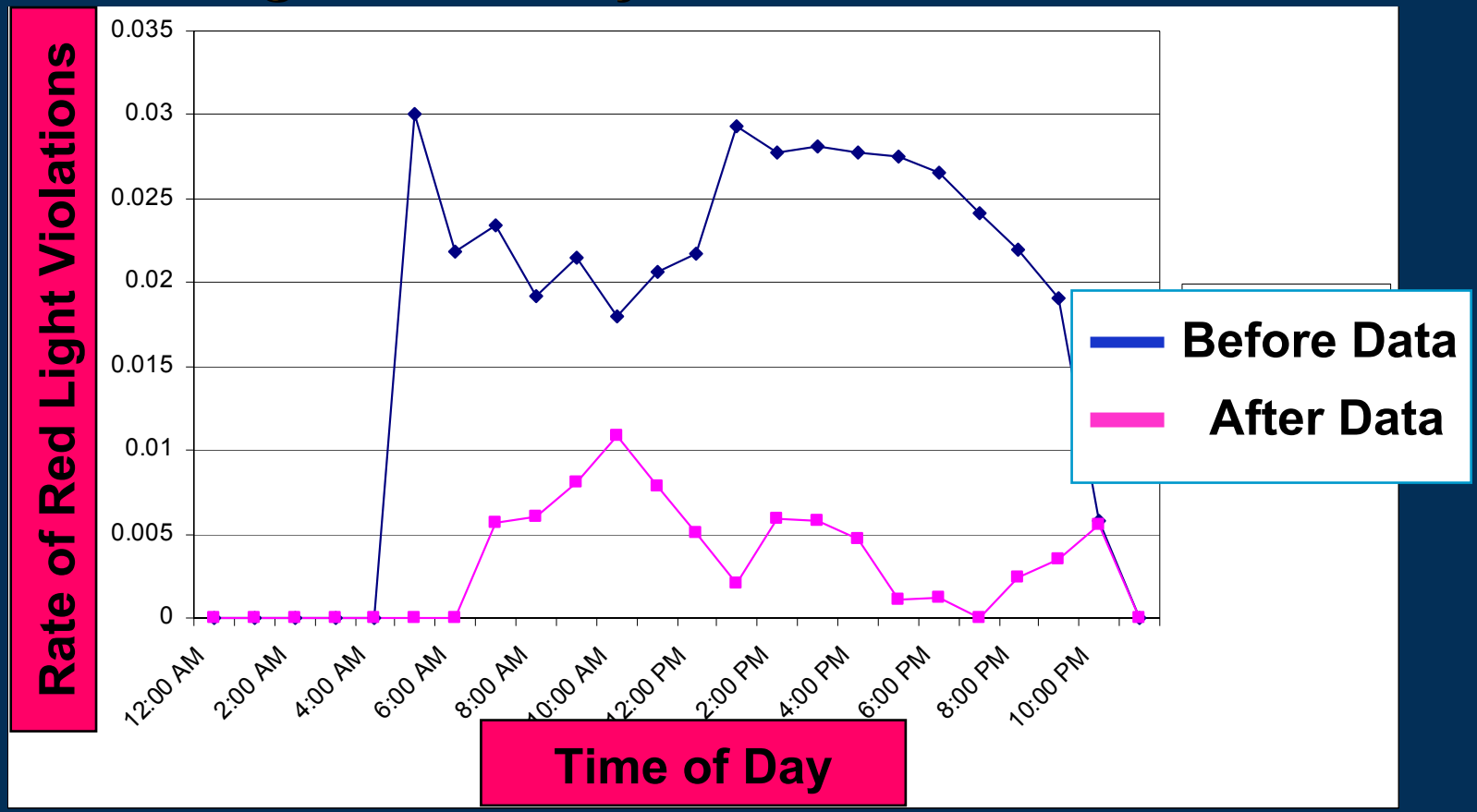
Red Light Running Results

Note: 3-hour running averages shown

- Red light violation rate was fairly consistent throughout the day



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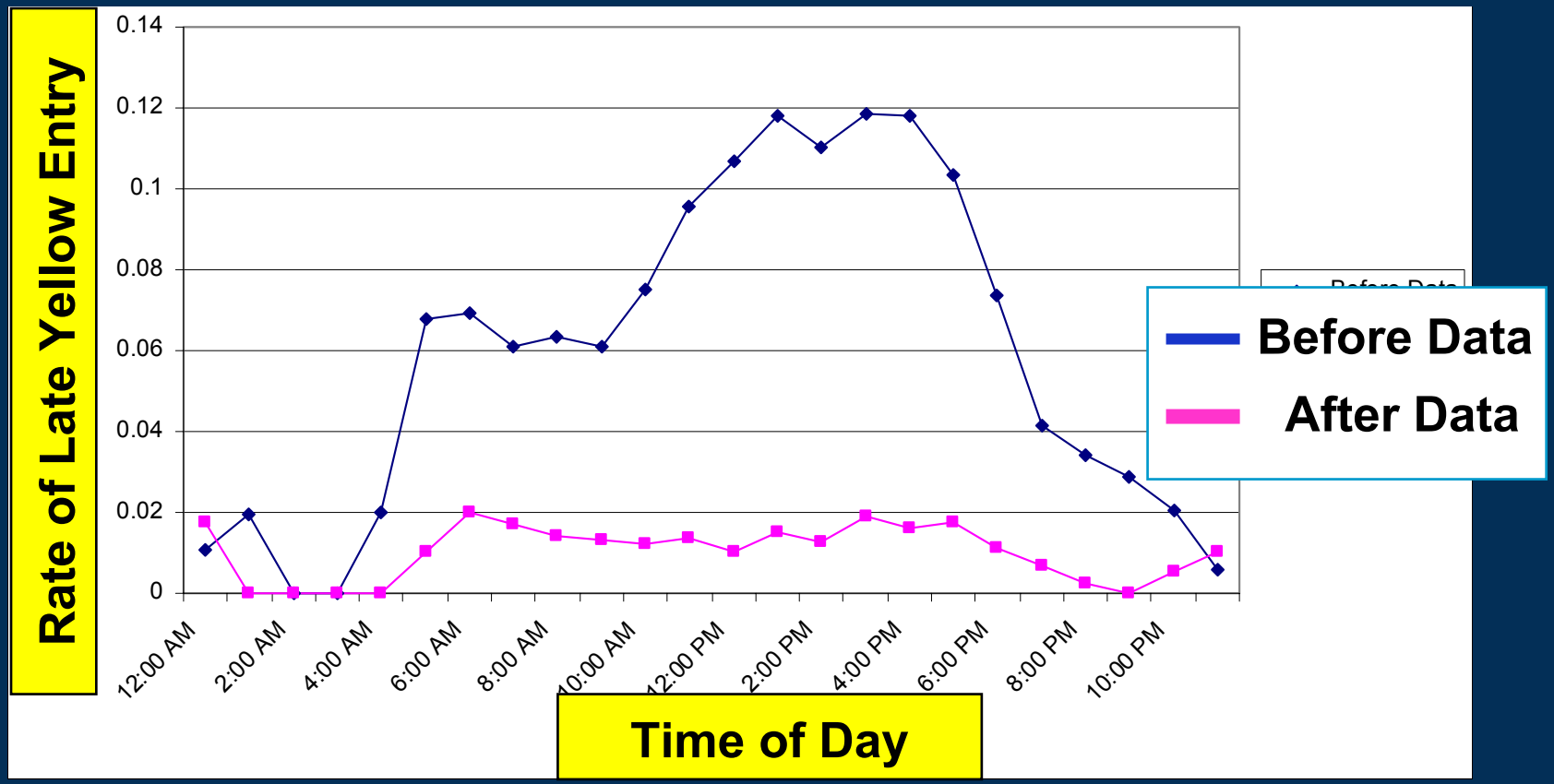
Late Yellow Entry Results

Note: 3-hour running averages shown

- Late yellow entry rate was most pronounced between noon and 6 PM



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Summary

- **The safety strategies yield results!**
  - Box span configuration
  - LED signal lamps with backplates
  - 12” traffic signal lenses
  - Optimized traffic signal timings
  - Updated traffic signal clearance intervals
  - Lane configuration modifications (provide left-turn lane) within existing roadway footprint
- **Additional benefits to law enforcement, first responders, maintenance personnel**

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Further Considerations

- **~ 50% crash reduction potentially achieved on both projects**
- **Limited exposure levels and available control group(s) for isolating the benefit of individual strategies**
- **Further research on impact of select individual strategies (such as box span) needs to be conducted**

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